ROLE OF MULTIDETECTOR COMPUTED TOMOGRAPHY IN THE EVALUATION OF PERITONEAL TUMORS

ESSAY

Submitted in Partial Fulfillment of the Master Degree in Radio diagnosis

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LIST OF ABBREVIATIONS

٣D	Three Dimensional
CA-١٢٥	cancer antigen ١٢٥
CT	Computed Tomography
DSRCT	Desmoplastic small round cell tumor
Fig	Figure
GIT	Gastro-intestinal tract
HHV	Human herpes virus ٨
MDCT	Multidetector computed Tomography
MIP	Maximum Intensity Projection
MPR	Multiplanar Reformation
OCMs	Oral contrast materials
PET/CT	Positron Emission Tomography/ Computed Tomography
PPSBT	Primary peritoneal serous borderline tumor
VR	Volume Rendering

INTRODUCTION

Computed tomography (CT) is an important imaging modality for diagnosis and follow-up of neoplastic and non-neoplastic conditions of the serosal membrane. **(Jeong et al., ٢٠٠٨).** Peritoneal disease can manifest at computed tomography (CT) as fluid accumulation within the peritoneal cavity (ascites) or soft-tissue infiltration of the various peritoneal ligaments and mesenteries.**(Pickhardt & Bhalla, ٢٠٠٥).**

Distinguishing a benign from a malignant process and a primary from a metastatic process is challenging. CT features combined with the patient's relevant clinical and demographic data can help narrow the differential diagnosis for a peritoneum-based neoplasm in many cases. CT is useful not only for the detection, characterization, and staging of primary neoplasms of peritoneal and subperitoneal origin, but also for guiding biopsy for tissue diagnosis.**(Pickhardt and Bhalla, ٢٠٠٥).**

Primary peritoneal tumors are uncommon lesions that arise from the mesothelial or submesothelial layers of the peritoneum. Primary malignant mesothelioma, multicystic mesothelioma, primary peritoneal serous carcinoma, leiomyomatosis peritonealis disseminata, and desmoplastic small round cell tumor are the most prominent of these rare lesions. (**Levy et al., ٢٠٠٨).**

However, these rare primary lesions are often first detected at computed tomography (CT) and should be considered in the absence of a known or suspected organ-based malignancy. **(Pickhardt and Bhalla, ٢٠٠٥).**

Tumors and tumor-like lesions that secondarily involve the mesothelial or submesothelial layers of the peritoneum are a diverse group of disorders that range in biologic behavior from benign to highly malignant**.** The anatomy of peritoneal ligaments and mesenteries and the normal circulation of peritoneal fluid dictate location and distribution of these diseases within the peritoneal cavity. (**Levy et al.,٢٠٠٩).**

The CT findings of secondary tumors include a variable amount of fluid in the serosal cavity, thickening of the serosal lining (irregular and nodular), and serosal implants. **(Jeong et al.,٢٠٠٨**.)

Tumor-like conditions that may affect the peritoneum include Endometriosis, Gliomatosis peritonei, Osseous metaplasia, Cartilagenous metaplasia, Melanosis and Splenosis. **(Levy et al.,٢٠٠٨).**

Recent advances in CT technology have increased the flexibility of image acquisition, thereby allowing the use of thin sections and multiplanar reformatting. With multidetector CT, thin-section images of the abdomen and pelvis can be obtained to assess for subcentimeter implants and to create three-dimensional images with reduced artifact. **(Pannu et al.,٢٠٠٣).**

Multiplanar reformatting can be used to confirm the presence of implants. Structures such as the diaphragm, paracolic gutters, bowel, and cul-de-sac can be evaluated in multiple planes for surface nodularity and small implants. Interactive multiplanar review of the abdomen and pelvis has the potential to improve detection of peritoneal metastases at CT. **(Pannu et al ,٢٠٠٣).**

AIM OF THE WORK

The aim of this work is to illustrate the role of the multidetector CT imaging in evaluation of primary and secondary tumors and tumor-like lesions of the peritoneum.

I.Gross anatomy

The peritoneum is a thin, translucent, serous membrane and is the largest and most complexly arranged serous membrane in the body. The peritoneum that lines the abdominal wall is called the parietal peritoneum, whereas the peritoneum that covers a viscus or an organ is called a visceral peritoneum. **(Kim et al., ٢٠٠٧).**

The visceral peritoneum covers the intraperitoneal organs (stomach, jejunum, ileum, transverse colon, sigmoid colon, liver, and spleen), omenta and mesenteries. The parietal peritoneum lines the anterior, lateral, and posterior abdominal walls; undersurface of the diaphragm; anterior surface of the retroperitoneal viscera (duodenum, ascending and descending colon, pancreas, and portions of the adrenal glands and kidneys); and the pelvis. **(Levy et al., ٢٠٠٨).**

The peritoneal cavity is the potential space between the layers of visceral and parietal peritoneum. In men, the peritoneal cavity is closed, but in women, it communicates with the extraperitoneal pelvis exteriorly through the fallopian tubes, uterus and vagina. **(Levy et al., ٢٠٠٨).**

A-Peritoneal ligaments

Peritoneal ligaments are double layers or folds of peritoneum that support a structure within the peritoneal cavity; omentum and mesentery are specifically named peritoneal ligaments. **(Tirkes et al., ٢٠١٢).**

١-Suspensory ligaments of the liver

The suspensory ligaments of the liver include the triangular and falciform ligaments. **(Tirkes et al., ٢٠١٢).**

Triangular Ligaments

Triangular ligaments result from fusion of peritoneal reflections rather than remnant embryonic mesentery. The left triangular ligament is formed by the fusion of the inferior and superior reflections of the coronary ligaments. It is short and does not compartmentalize the left subphrenic space. The right triangular ligament is formed by the fusion of the superior and inferior reflections of the right coronary ligament

(Fig.١). Unlike the left triangular ligament, the right triangular ligament is long and separates the right subphrenic space from the right subhepatic space. The triangular ligaments outline the bare area of the liver. **(Tirkes et al., ٢٠١٢).**

Falciform Ligament

The falciform ligament is the remnant of the most ventral part of the ventral mesentery and contains the obliterated umbilical vein. It is a relative (incomplete) barrier to the transfer of fluid from the right subphrenic space to the left subphrenic space. It is important to realize that subperitoneal tumor spread in the falciform ligament may mimic liver metastasis **(Fig. ١). (Kim et al., ٢٠٠٧).**

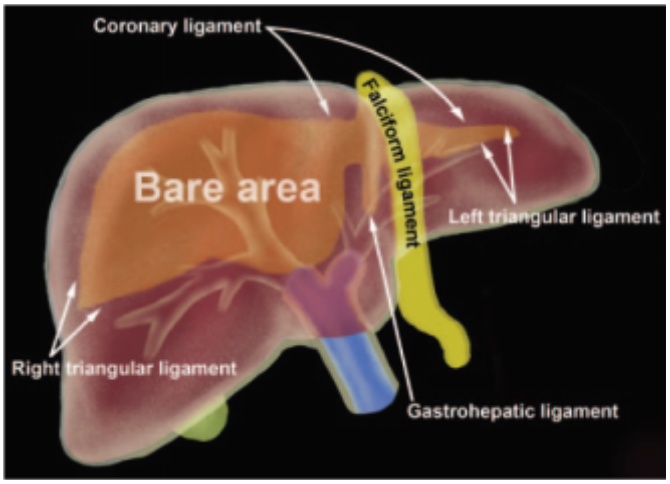

Fig. ١. Diagram shows the perihepatic ligaments and the bare area of the liver. **(Kim et al., ٢٠٠٧).**

٢-Peritoneal ligaments of the stomach

The omentum is a double-layered extension of the peritoneum that connects the stomach to adjacent organs. **(Yoo et al., ٢٠٠٧).**

Lesser omentum

The gastrohepatic and hepatoduodenal ligaments are contiguous peritoneal ligaments that form the lesser omentum **(Fig. ٢)**. The gastrohepatic ligament attaches the lesser curve of the stomach to the liver and contains the coronary vein and left gastric artery. The hepatoduodenal ligament attaches the duodenum to the liver and contains the portal vein, hepatic artery, common hepatic ducts, and part of the cystic duct. **(Tirkes et al., ٢٠١٢).**

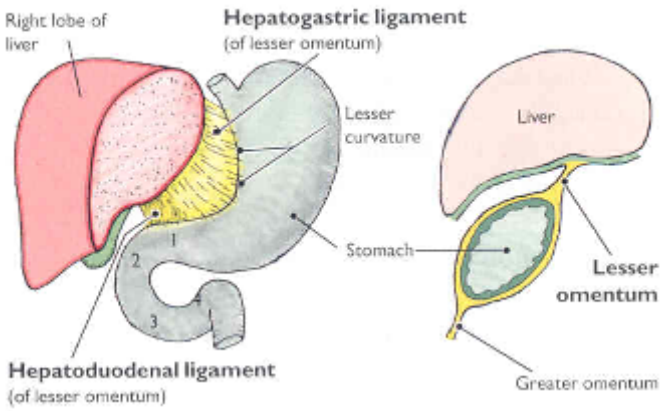

Fig. ٢. Diagram shows ligaments of lesser omentum. **(http://academic.amc.edu).**

Gastrosplenic Ligament

The ventral part of the dorsal mesentery extends between the greater curve of the stomach and the spleen. The superior part of this portion of the dorsal mesentery becomes the gastrosplenic ligament , which contains the short gastric vessels and a collateral route of venous flow after splenic vein thrombosis. **(Oliphant et al., ١٩٩٦).**

Greater omentum

The gastrocolic ligament, or the greater omentum is attached to the stomach and hangs like an apron from the transverse colon. The greater omentum may become visible if it is diseased or if ascites is present **(Fig. ٣)**. **(Yahoo et al., ٢٠٠٧).**

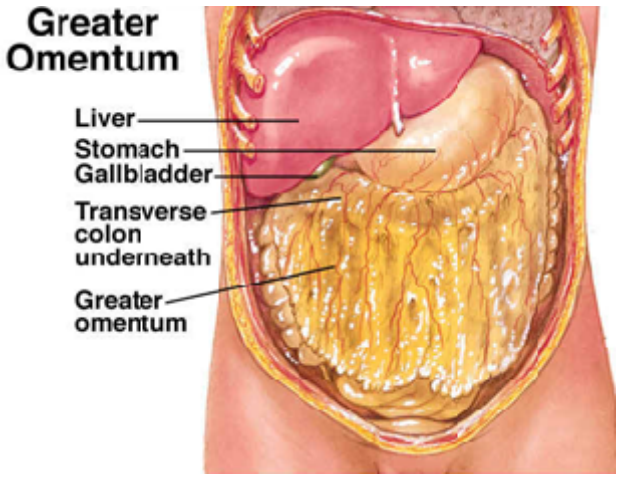

Fig. ٣. Diagram shows greater omentum. **(http://faculty.southwest.tn.edu).**

Splenorenal Ligament

The splenorenal ligament is the most dorsal aspect of the dorsal mesentery. It contains the pancreatic tail and splenorenal collateral vessels in patients with portal hypertension. **(Tirkes et al., ٢٠١٢).**

٣-Mesentery

Mesentery is a double layer of peritoneum that encloses an organ and connects it to the abdominal wall. The mesenteric contents include blood vessels, lymph nodes, nerves, and fat **(Fig. ٤)**. **(Tirkes et al., ٢٠١٢).**

Transverse mesocolon

The transverse mesocolon is a peritoneal fold that attaches the transverse colon to the retroperitoneum and contains the middle colic vessels **(Fig. ٤)**. **(Charnsangavej et al., ١٩٩٣).**

Small bowel mesentery

The small bowel mesentery attaches the small bowel to the retroperitoneum and extends from the ligament of Treitz to the ileocecal valve. It contains the superior mesenteric vessels and their branches **(Fig. ٤)**. **(Tirkes et al., ٢٠١٢).**

Sigmoid mesocolon

The sigmoid mesocolon is a peritoneal ligament that attaches the sigmoid colon to the posterior pelvic wall and contains the hemorrhoidal and sigmoid vessels **(Fig. ٤)**. **(Tirkes et al., ٢٠١٢).**

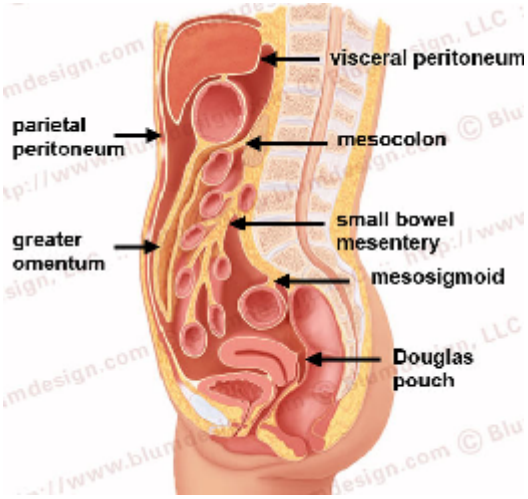

Fig. ٤. Diagram shows mesentery. **(http://www.radiologyassistant.nl).**

B-Peritoneal spaces:

The peritoneal cavity is divided into two main compartments the supramesocolic and inframesocolic compartments by the transverse mesocolon. **(Tirkes et al., ٢٠١٢).**

The supramesocolic compartment is divided into right and left supramesocolic spaces by the falciform ligament. The right supramesocolic space includes the right subphrenic (subdiaphragmatic) space and right subhepatic space (Morison pouch or hepatorenal space) and lesser sac (omental bursa). The left supramesocolic space consists of the left subphrenic space, left subhepatic space (gastrohepatic recess) **(Fig. ٥)**. **(Jeong et al ٢٠٠٨).**

The lesser sac contains a superior recess (located above the peritoneal reflection of the left gastric artery) that is in close proximity to the caudate lobe and has a boomerang-shaped recess and a larger inferior recess that lies between the stomach and the pancreatic body **(Fig. ٥)**. The superior and inferior recesses are separated by a peritoneal fold that accompanies the left gastric artery. **(Tirkes et al., ٢٠١٢).**

Sometimes, the inferior recess communicates with a potential space between the leaves of the greater omentum. On the right side, the inferior recess communicates with the subhepatic space through the foramen of Winslow (epiploic foramen). **(Tirkes et al., ٢٠١٢).**

The inframesocolic compartment is divided into the right and left inframesocolic spaces by the root of the small bowel mesentery. The right inframesocolic space can be divided into the right paracolic gutter and the right infracolic space. The left inframesocolic space consists of the left paracolic gutter and the left infracolic space **(Fig. ٥)**. The intraperitoneal pelvic cavity is anatomically continuous with the right and left paracolic gutters. **(Jeong et al., ٢٠٠٨).**

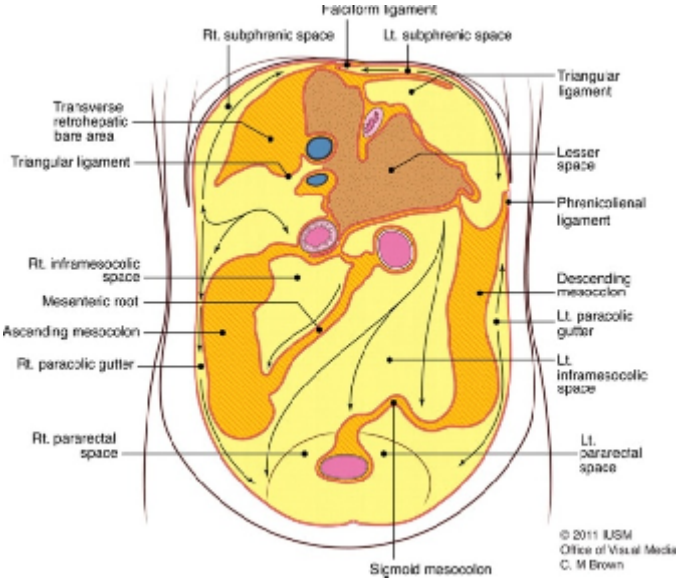

Fig. ٥. Supramesocolic and inframesocolic peritoneal spaces. Diagram shows the peritoneal spaces and the direction of flow (arrows) of the small amount of normal peritoneal fluid. **(Tirkes et al., ٢٠١٢).**

In the pelvis, the dependent peritoneal recesses are the retrouterine pouch in the female (also called the rectouterine, cul-de-sac or pouch of Douglas), the retrovesical pouch in the male, and the lateral paravesical recesses in both sexes **(Fig. ٦)**. **(Levy et al ٢٠٠٨).**

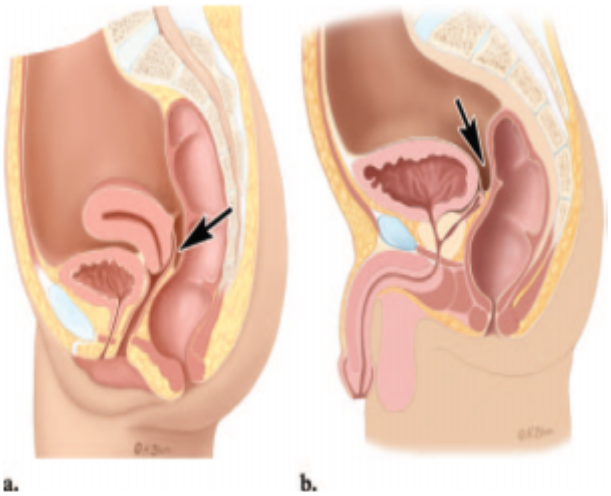

Fig. ٦. Normal peritoneal reflections in the pelvis. **(a)** Sagittal drawing of the female pelvis shows the retrouterine pouch is the space between the uterus and rectum (arrow). **(b)** Sagittal drawing of the male pelvis shows the retrovesical space (arrow) is between the bladder and rectum. **(Levy et al ٢٠٠٨).**